

CLAIMS

WHAT IS CLAIMED IS:

1 1. In a system for presenting an audio stimulus having an input, an amplifier, an
2 attenuator and a transducer, a method of predicting a sound pressure level emitted by the
3 transducer comprising:
4 applying a broadband audio signal to the input;
5 inserting a first attenuation between the amplifier and the transducer;
6 measuring a first output from the transducer;
7 calculating a first transfer function for a signal path from the input to the measured first
8 output;
9 inserting a second attenuation between the amplifier and the transducer;
10 measuring a second output from the transducer;
11 calculating a second transfer function for a signal path from the input to the measured
12 second output;
13 combining the first and second transfer functions to solve for a characteristic impedance
14 and sensitivity of the transducer;
15 calculating a sound pressure level emitted by the transducer as a function of input signal
16 and attenuation.

1 2. The method of claim 1 further comprising measuring the broadband audio signal
2 applied at the input simultaneously with measuring the first and second outputs from the
3 transducer.

3. The method of claim 2 wherein the first and second transfer functions are calculated as respective ratios of the first and second measured outputs to the corresponding measured inputs.

4. The method of claim 3 wherein each of the first and second transfer functions is expressed as a product of an amplifier transfer function, an attenuator transfer function, an electrical-to-acoustical transfer function and an acoustical-to-electrical transfer function.

5. The method of claim 4 wherein the characteristic impedance of the transducer is calculated as:

$$Z_L(f) = \frac{H_{BD}(f, R_1, A, Z_L) \times R_1 - H_{BD}(f, R_2, A, Z_L) \times R_2}{H_{BD}(f, R_2, A, Z_L) - H_{BD}(f, R_1, A, Z_L)}.$$

6. The method of claim 5 wherein the sensitivity of the transducer is calculated as:

$$A(f) = \left| \frac{H_{BD}(f, R_1, A, Z_L) \times [Z_L(f) + R_1]}{H_{AMP}(f) H_{A2E}(f) \sqrt{Z_L(f)}} \right|.$$

7. The method of claim 6 wherein the sound pressure level is calculated as:

$$20 \log_{10} \left(\sqrt{\frac{\sum_f \left| Y_X(f) \cdot H_{D2E}(f) \cdot H_{BD}(f, R_1, A, Z_L) \cdot \frac{H_{ATTN}(f, R_A, Z_L)}{H_{ATTN}(f, R_1, Z_L)} \right|^2}{M}} \times \frac{1}{H_{A2E}(f) \cdot p_0} \right).$$

1 8. The method of claim 6 wherein the sound pressure level is calculated as:

2
$$10\log_{10}\left(\frac{\sum_f \left| Y_X(f) \cdot H_{D2E}(f) \cdot H_{BD}(f, R_1, A, Z_L) \cdot \frac{H_{ATTN}(f, R_A, Z_L)}{H_{ATTN}(f, R_1, Z_L)} \right|^2}{\sum_f \left| Y_{XREF}(f) \cdot H_{D2E}(f) \cdot H_{BD}(f, R_1, A, Z_L) \right|^2}\right) + N.$$

1 9. The method of claim 6 wherein the sound pressure level is calculated as:

2
$$20\log_{10}\left(\sqrt{\frac{\sum_f \left| Y_X(f) \cdot H_{D2E}(f) \cdot H_{BD}(f, R_1, A, Z_L) \cdot \frac{H_{ATTN}(f, R_A, Z_L)}{H_{ATTN}(f, R_1, Z_L)} \cdot H_{A-W}(f) \right|^2}{M}} \times \frac{1}{H_{A2E}(f) \cdot p_0}\right).$$

1 10. The method of claim 6 wherein the sound pressure level is calculated as:

2
$$10\log_{10}\left(\frac{\sum_f \left| Y_X(f) \cdot H_{D2E}(f) \cdot H_{BD}(f, R_1, A, Z_L) \cdot \frac{H_{ATTN}(f, R_A, Z_L)}{H_{ATTN}(f, R_1, Z_L)} \cdot H_{A-W}(f) \right|^2}{\sum_f \left| Y_{XREF}(f) \cdot H_{D2E}(f) \cdot H_{BD}(f, R_1, A, Z_L) \right|^2}\right) + N.$$

1 11. The method of claim 1 wherein the transducer is an acoustic transducer.

1 12. The method of claim 1 wherein the transducer is a vibratory transducer.

1 13. The method of claim 1 wherein the transducer is characterized by a transfer
2 function and further comprising inserting an inverse filter to equalize the transducer transfer
3 function.

1 14. The method of claim 1 wherein the attenuator is characterized by a transfer
2 function and further comprising inserting an inverse filter to equalize the attenuator transfer
3 function.

1 15. The method of claim 1 wherein the solution for the characteristic impedance of
2 the transducer is expressed as a function of frequency.

1 16. The method of claim 1 wherein the solution for the sensitivity of the transducer is
2 expressed as a function of frequency.